CAMELIACOL 8M

8 MEGAPIXEL COLOR DIGITAL CAMERA

User guide

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CAMELIA PACKAGE CONTENTS :

Depending on the selected configuration, a CAMELIA package may include :

- CAMELIA COLOR camera
- FGT COLOR frame grabber board
- ''Power supply'' cable + ''RS232'' cable
- ''Data & Sync'' cable.
- CDROM "Cameras Software & Documentations" including :
  - ◊ 'COMMCAM software.
  - ◊ FGT software.
  - ◊ Documentation (This Manual) and for all ATMEL Cameras
  - ◊ FAQ, examples

SYSTEM REQUIREMENTS :

- +24V(0.6A) power supply
- NIKON lens
- lightning control :
  - ◊ shutter / chopper or pulsed lightning
  - ◊ IR cut-off filter : BG38 2mm recommended.

COMPUTER REQUIREMENTS :

- Minimal hardware configuration :
  - ◊ PENTIUM II or higher.
  - ◊ 128 Mo RAM (256 Mo Recommended for Window 2000)
  - ◊ 256 Ko cache memory.
  - ◊ 1 free PCI slot. (PCI review 2.1 or higher)
  - ◊ For color imaging : graphic card compatible with Direct Draw tools and overlay mode, 16.7 millions colors.
- Operating system :
  - ◊ Windows NT 4.0 or 2000
  - ◊ Windows 95b, 98.

GETTING STARTED :

- connect the camera to one of the computer serial ports (COM1 or COM2) by using the RS232 cable
- power on the camera
- install ''COMMCAM'' software in your computer. (see "COMMCAM User Guide")
- install FGT COLOR frame grabber board and FGT software in your computer. (see "FGT Frame Grabber User Guide")
- run the system

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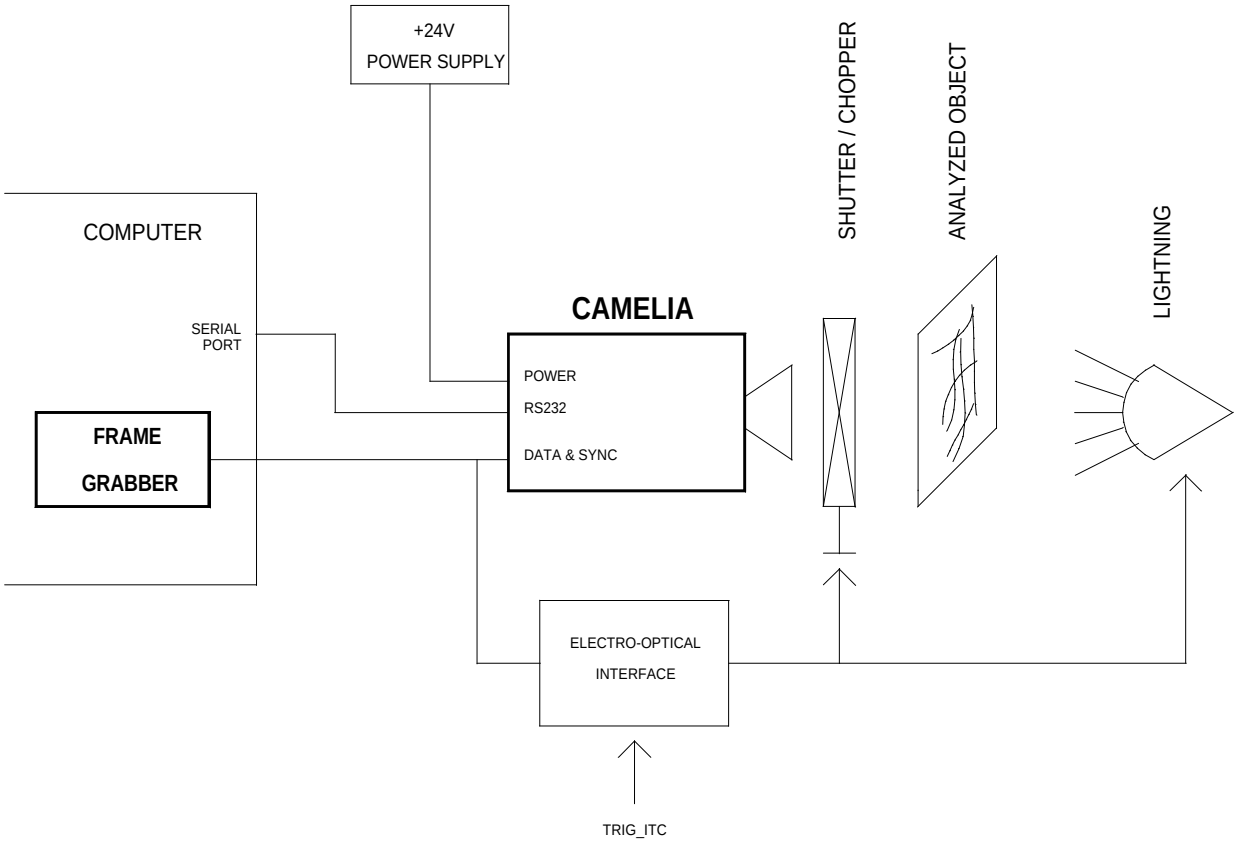
1. IMAGING SYSTEM DESCRIPTION



- CAMELIA camera is powered by a +24V power supply.
- CAMELIA camera is configured through the serial port of the computer.
- CAMELIA camera sends digital video to the FGT frame grabber.
- As CAMELIA 's CCD is a full frame sensor, you must use either pulsed lightning or a chopper/shutter in front of the camera in order to have incident lightning on the CCD only during integration time. You must design an electro-optical interface to drive camera, shutter/chopper or lightning by using the "SHUTTER" signal delivered by the camera. If required, the system can send an external trigger or external ITC (integration time control signal) to the camera.

2. CCD DESCRIPTION

- image format : 35.0mm(V) x 23.0mm(H)
- active pixels :

Mode (set via RS232)	Image size (H x V)
No binning	2300 x 3500
2x2 pixel binning	1150 x 1750
4x4 pixel binning	574 x 875

- readout register along the small side of the image area. (vertical image)
- pixel geometry :
  - 10µm(V) x 10µm(H).
  - aperture ratio : 100%.
- filter mosaic : BAYER pattern :

B	G	B	G
G	R	G	R
B	G	B	G
G	R	G	R

  - note : first active pixel of first active line : blue.
- anti-blooming by clocking.

3. TIMING

2x2 and 4x4 pixel binning are possible to enable previewing modes.

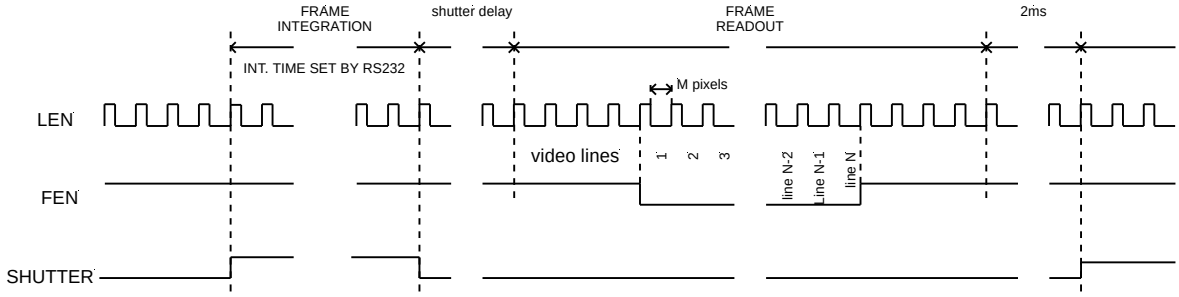
3.1 FRAME TIMING

- frame readout time :
  - normal mode : 370ms
  - 2x2 pixel binning : 200ms.
  - 4x4 pixel binning : 110ms.

3 timing modes are available.

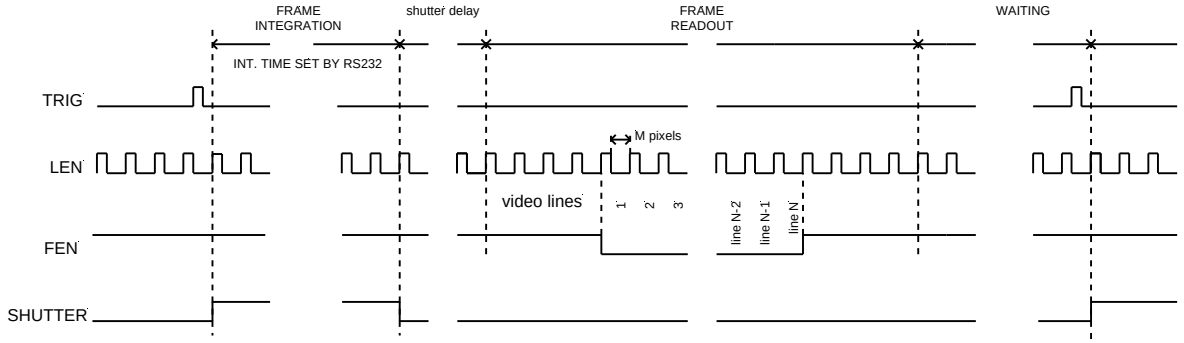
3.1.1 CONTINUOUS

- the camera delivers frames continuously :
  - frame N+1 integration starts as soon as frame N readout is completed.
  - integration time is set by RS232



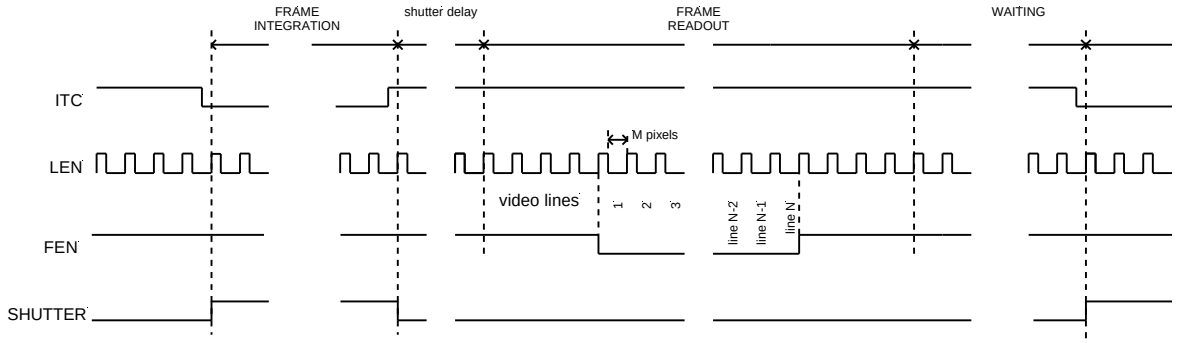
3.1.2 OPERATION WITH EXTERNAL TRIGGER

- integration start is controlled by the user from the external signal TRIG :
  - The rising edge of TRIG activates the start of the frame integration. This rising edge is synchronized by the camera with a precision of 62µs
  - Integration time is set by RS232
  - Note : TRIG signal period must be greater than integration time plus frame readout time.



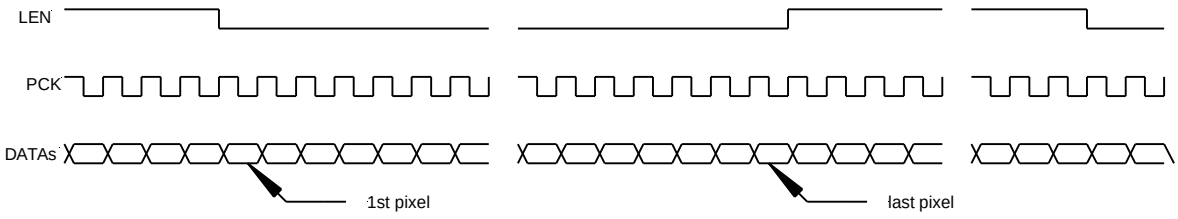
3.1.3 *OPERATION WITH "INTEGRATION TIME CONTROL"*

- integration is fully controlled by the user from the external signal ITC :
  - The falling edge of ITC activates the start of the frame integration. This falling edge is synchronized by the camera with a precision of 62µs
  - The rising edge of ITC activates the stop of the frame integration. This rising edge is synchronized by the camera with a precision of 62µs
  - Note : ITC signal period must be greater than integration time (defined by ITC low) plus frame readout time.



3.2 LINE TIMING.

- Duty cycle of the PCK is 50%.
- Rising and falling edges : 1,5 nsec.
- Data rate is (pixel clock) : 25 MHz



3.3 ANTI-BLOOMING BY CLOCKING

Anti-blooming can be activated or inhibited (see RS232 control):

- ◊ Anti-blooming OFF : anti-blooming inhibited. This position is recommended if anti-blooming is not required for the application.
- ◊ Anti-blooming ON : anti-blooming activated.

3.4 VIDEO SIGNAL PROCESSING GAIN

Video signal processing gain can be adjusted by setting the "CDS gain" via RS232 : a commutation 1x or 4x is available at the input of the video signal processing. The 4x position is recommended for low level applications (noise is lower).

4. R.O.IS (REGIONS OF INTEREST).

CAMELIA 8M can operate in a “multi ROI” mode allowing masking of regions of the image and thus increasing frame rate by a reduced readout time.

User defines up to 5 windows to be masked. In addition he specifies starting and ending addresses for each window.

Time reduction : about 92 µsec per masked line.

Two steps :

- Enter the number of regions masked by the CommCam command : F=X (X=0 to 5)
- Enter the list of starting and ending addresses by the CommCam command : Y=ssss/eeee/ssss/eeee/…/eeee/

For example : how to mask 2 regions of 500 lines each, one on the top of image, the second on the bottom, 1x1 pixel binning :

CommCam commands : F=2 then Y=0/500/3000/3500/

In this example readout time will be reduced of 1000 lines equivalent to 92 msec.

5. ENVIRONMENTAL REQUIREMENTS

- ♦ Operating temperature : 0°C / +50°C
- ♦ Storage temperature : -20°C / 70°C
- ♦ Operating humidity : < 80% at +35°C
- ♦ Vibration : 2g sinusoidal, from 10Hz to 100Hz.

6. ELECTRICAL INTERFACES

6.1 POWER SUPPLY

Voltage	Current
+24V Min : +20V; Max : +28V	0.6A

6.2 DIGITAL I/O

SYMBOL	I/O	DEFINITION	LEVEL
TRIG_ITC	I	Timing control : TRIG_ITC is either an external trigger or "integration time control" depending on the timing mode configured via RS232. operation with external trigger : TRIG_ITC = TRIG operation with "integration time control" : TRIG_ITC = ITC TRIG_ITC is synchronized by the camera line clock (jitter : 110 µs)	LVDS
COLOUR_I(1..0)	I	Color selection of the next frame (in color mode) : - "00" : red - "01" : green - "10" : blue	LVDS
S(11..0)	O	Digital video output : 12 bits	LVDS
FEN		Frame enable : - FEN = 0 : frame data valid : active lines - FEN = 1 : frame data not valid	LVDS
LEN	O	Line enable : - LEN = 0 : line data valid : active pixels - LEN = 1 : line data not valid	LVDS
PCK	O	Pixel clock	LVDS
COLOUR_O(1..0)	O	Color identification of the current frame (in color mode) : - "00" : red - "01" : green - "10" : blue.	LVDS
SHUTTER	O	shutter open/close : - during integration : shutter = 1 - during readout : shutter = 0 delay between the falling edge of shutter and the start of readout : - 4 positions : 1ms, 5ms, 10ms, 20ms. (set via RS232)	LVDS

Note :

- LVDS drivers / receivers :
  - LVDS : Low Voltage differential Signal. (EIA 644 standard). All digital I/Os are differential : (signal+, signal-). Specifications are given for signal +.
  - manufacturer NS
  - driver : DS90C031TM (SO16 package)
  - receiver : DS90C032TM (SO16 package)

7. RS232 CONTROLS

Camera configuration is set by RS232 interface. The following features are available :

Function	RS232 configuration	Comment
Timing mode	3 modes : - continuous (free running) - external trigger - external ITC	
Binning	3 modes : - no binning - 2x2 pixel binning - 4x4 pixel binning	 image size : 2300(H) x 3500(V) image size : 1150(H) x 1750(V) image size : 574(H) x 875(V)
CDS gain	2 positions : - G = 1 - G = 4	G = 4 is recommended for applications requiring high sensitivity.
Shutter	2 modes : - active - inactive (always open)	
Shutter delay	4 positions : - 1ms - 5ms - 10ms - 20ms	
Anti-blooming control	2 modes : - active - inactive	
Black and white or color Mode	2 modes : - black and white - 3 shot color	
Black and white integration time	integration time value in ms from 1ms to 2000ms. active only in "black and white" mode.	Must be an integer. Ex : 120 for 120ms 120.4 not allowed.
Red integration time	integration time for the red frame value in ms from 1ms to 2000ms. active only in "3 shot color" mode.	Must be an integer. Ex : 120 for 120ms
Green integration time	integration time for the green frame value in ms from 1ms to 2000ms. active only in "3 shot color" mode.	Must be an integer. Ex : 120 for 120ms
Blue integration time	integration time for the blue frame value in ms from 1ms to 2000ms. active only in "3 shot color" mode.	Must be an integer. Ex : 120 for 120ms

Note : video signal processing gain of the camera can be adjusted by setting ‘’CDS gain’’ :

A commutation 1x or 4x is available at the input of the video signal processing. Use of the 4x position is recommended for low level applications (noise is lower)

8. SPECIFICATIONS

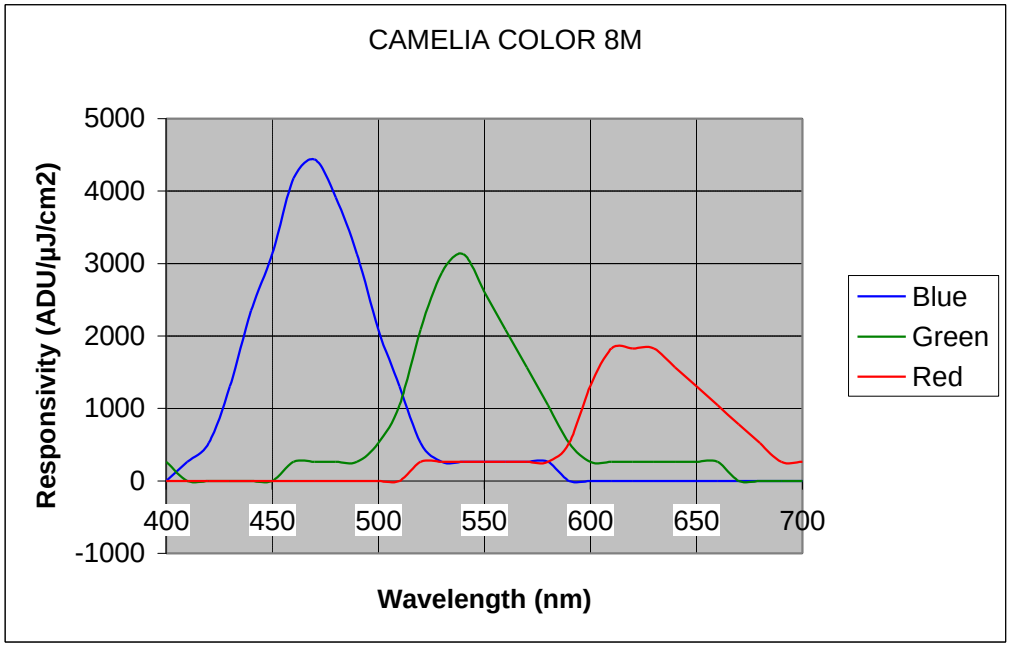
8.1 ELECTRO-OPTICAL PERFORMANCE

- Conditions :
  - frame integration time : 40ms
  - camera operating free air temperature : 25°C
- Performance :

Parameter	Symbol	Typical Value	Unit
Full scale value see note 2	VPE	4095	adu
Temporal noise σ see note 3	VN	2.7	adu
Dark signal non uniformity σ see note 4	DSNU	2	adu
Dynamic range see note 5	DY	1700	
Responsitivity @ 3200k - red channel - green channel - blue channel @ 5200k - red channel - green channel - blue channel see note 6	 Rr Rg Rb Rr Rg Rb	 2.8 2.7 2.2 2.0 2.9 3.8	adu/(lux.s)
Resolution - horizontal resolution - vertical resolution see note 7	 TBD TBD		
Anti-blooming - over illumination capability see note 8		8x	

- note 1 : adu : arbitrary digital unit : 12 bit = 4095 adu or gray levels.
- note 2 : full scale value VPE : maximum digital video signal
- note 3 : temporal noise VN : r.m.s value in darkness. Measured by subtracting 2 images pixel to pixel
- note 4 : dark signal non uniformity : r.m.s value. Excludes blemishes.
- note 5 : dynamic range DY :
  - DY = VPE / VN
- note 6 : responsitivity :
  - conditions :
    - CDS gain = 1x.
    - With BG38 2mm
    - lens aperture : F/4.
    - lux on the scene taking into account : scene reflectance 80%, lens transmission 80%
- note 7 : resolution :
  - conditions :
    - light source 3200K, BG38 2mm.
    - VIDEO = 2000 adu, CDS gain = 1x.
- note 8 :
  - anti-blooming ON
  - integration time = 100ms.

8.2 SPECTRAL RESPONSIVITY



Note : nJ/cm^2 measured on the CCD chip.
Including BG38 2mm.

8.3 IMAGE GRADE SPECIFICATION

8.3.1 DEFINITIONS

- Defect sizes
  - Blemish : 1 x 1 defect.
  - Cluster : blemish grouping of not more than a given number of adjacent defects :
    1 x 1 < **cluster 1** size ≤ 2 x 2
    2 x 2 < **cluster 2** size ≤ 5 x 5
  - Column : one-pixel-wide column with more than 15 contiguous defective pixels.
  - Defect separation : Defects are separated by no less than "**D min**" pixels in any direction.

- Defects in darkness
  - blemish or cluster : pixel(s) whose signal deviate(s) more than 150 ADU *****.
  - Column : column whose signal deviates more than 15 ADU *****.

- Defects under illumination
  - blemish or cluster : pixel(s) which deviate(s) by more than 20 % from the "average" pixel
  - column : column which deviates by more than 10 % from the "average" column.

***** ADU : Arbitrary Digital Unit : 12 bits correspond to 4095 ADUs. Deviations specified with CDS gain = 1.

8.3.2 DEFECT TEST CONDITIONS

- Room temperature = 20 ^{0} C
- Integration time in darkness = 100ms
- Light source : Halogen 3200K with BG38 (2mm thick) IR cut- off with f/3.5 aperture
- Test under illumination at 50% of saturation level
- No software correction performed

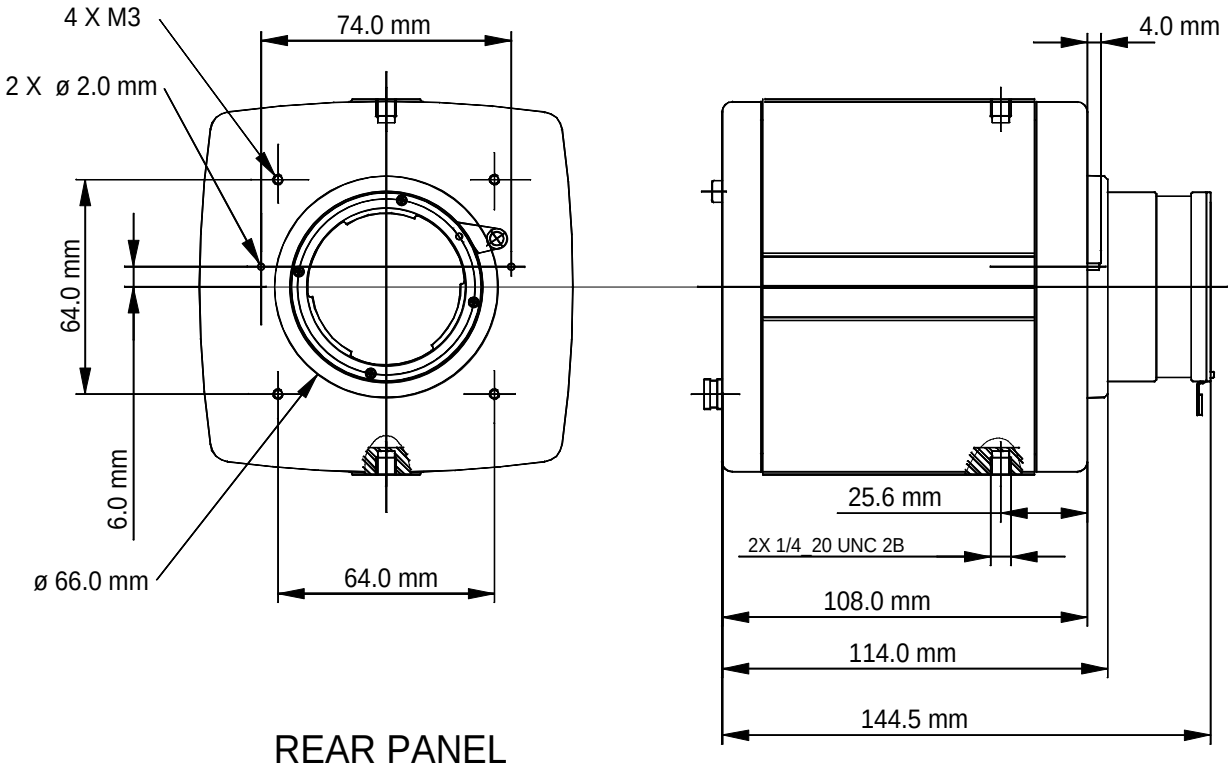
8.3.3 CLASSIFICATIONS

**** P R E L I M I N A R Y D A T A ****

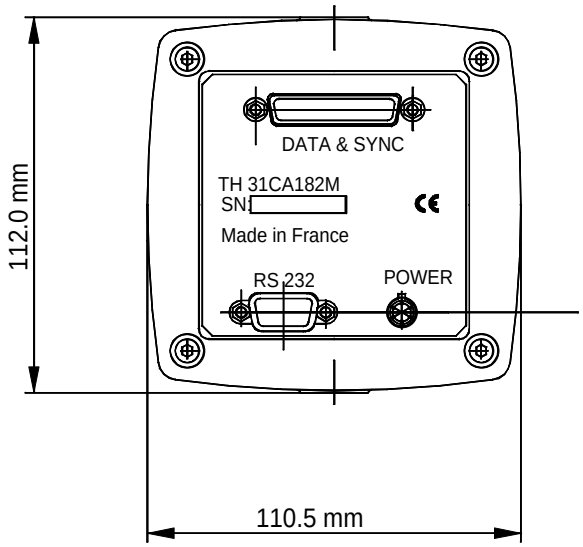
	Blemishes		**Cluster 1**		**Cluster 2**		**Column**	
Grade	**Total**	**D min**	**Total**	**D min**	**Total**	**D min**	**Total**	**D min**
E	≤ 1000	20	≤ 50	70	≤ 4	150	≤ 5	150
H	≤ 600	20	≤ 16	70	0	-	0	-

8.4 GEOMETRICAL SPECIFICATIONS

FRONT PANEL



REAR PANEL



Weight : 900 g

9. CONNECTORS AND CABLES

9.1 ''DATA AND SYNC'' CONNECTOR

50 pins connector.

- Connector reference :HIROSE DX10A-50S.
- Mating connector on cable side : HIROSE DX40-50P ; shell : HIROSE DX50-CV1.

Pin-out :

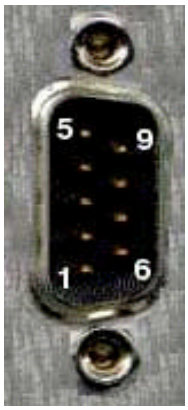
Pin n°	Signal		Pin n°	Signal
1	PCK+		26	LEN+
2	PCK-		27	LEN-
3	FEN+		28	COLOUR_O1+ (1)
4	FEN-		29	COLOUR_O1-(1)
5	COLOUR_O2+ (1)		30	GROUND
6	COLOUR_O2-(1)		31	GROUND
7	PDATA0+		32	PDATA1+
8	PDATA0-		33	PDATA1-
9	PDATA2+		34	PDATA3+
10	PDATA2-		35	PDATA3-
11	PDATA4+		36	PDATA5+
12	PDATA4-		37	PDATA5-
13	PDATA6+		38	PDATA7+
14	PDATA6-		39	PDATA7-
15	PDATA8+		40	PDATA9+
16	PDATA8-		41	PDATA9-
17	PDATA10+		42	PDATA11+
18	PDATA10-		43	PDATA11-
19	GROUND		44	NC
20	GROUND		45	NC
21	SHUTTER+		46	TRIG_ITC+
22	SHUTTER-		47	TRIG_ITC-
23	COLOUR_I1+(1)		48	COLOUR_I2+(1)
24	COLOUR_I1-(1)		49	COLOUR_I2-(1)
25	NC		50	NC

- Notes :
  - NC : not connected.
  - A "Data + Sync" cable is provided with FGT Frame grabber. This cable allow interconnection between :
    - The camera,
    - The Electro-optical interface,
    - The "FGT" frame grabber : see "FGT Frame Grabber user manual".

9.2 POWER SUPPLY

Hirose 6 pins male
HR10A-7R-6P

Pin Number At camera output	Signal	Pin Number At end of power supply cable
5	+24V	1
6	+24V	2
	NC	3
	NC	4
	NC	5
1	GROUND	6
2	GROUND	7
	NC	8
	NC	9



SUBD9 male

- notes :
  - ◊ NC : not connected.
  - ◊ A "power supply " cable is provided with FGT Frame grabber.

9.3 RS232

- On camera Dsub 9pins.
- On computer side Dsub9 female, pin out compatible with computer serial port
- note : pin out is the same on camera side and on computer side.

Pin Number At camera output	Signal
1	NC
2	RX
3	TX
4	NC
5	GROUND
6	NC
7	TRS
8	CTS
9	NC

- notes :
  - ◊ NC : not connected.
  - ◊ A "RS232 " cable is provided with FGT Frame grabber.

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